



US006324014B1

(12) **United States Patent**
Moskovich

(10) **Patent No.: US 6,324,014 B1**
(45) **Date of Patent: Nov. 27, 2001**

(54) **WIDE FIELD OF VIEW PROJECTION
LENSES FOR COMPACT PROJECTION
LENS SYSTEMS EMPLOYING PIXELIZED
PANELS**

(75) **Inventor: Jacob Moskovich, Cincinnati, OH (US)**

(73) **Assignee: Corning Precision Lens, Cincinnati,
OH (US)**

(*) **Notice:** Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

(21) **Appl. No.: 09/554,135**

(22) **PCT Filed: Nov. 10, 1998**

(86) **PCT No.: PCT/US98/23937**

§ 371 Date: **May 10, 2000**

§ 102(e) Date: **May 10, 2000**

(87) **PCT Pub. No.: WO99/26090**

PCT Pub. Date: May 27, 1999

Related U.S. Application Data

(60) **Provisional application No. 60/065,308, filed on Nov. 13,
1997.**

(51) **Int. Cl.⁷ G02B 3/00; G02B 13/18**

(52) **U.S. Cl. 359/651; 359/716; 359/717;
359/649**

(58) **Field of Search 359/649-651,
359/716, 717, 722, 723**

(56) **References Cited**

U.S. PATENT DOCUMENTS

Re. 35,310	8/1996	Moskovich	359/649
4,189,211	2/1980	Taylor	359/663
4,425,028	1/1984	Gagnon et al.	359/246
4,461,542	7/1984	Gagnon	349/8
4,767,199	8/1988	Yamamoto et al.	359/649
4,778,264	10/1988	Matsumura et al.	359/649
4,801,196	1/1989	Betensky	359/649
4,826,311	5/1989	Ledebuhr	353/31
5,042,929	8/1991	Tanaka et al.	359/708

5,179,473	1/1993	Yano et al.	359/691
5,200,861	4/1993	Moskovich	359/662
5,218,480	6/1993	Moskovich	359/753
5,278,698	1/1994	Iizuka et al.	359/682
5,313,330	5/1994	Betensky	359/676
5,319,495	6/1994	Yamada	359/691
5,331,462	7/1994	Yano	359/689
5,493,446	2/1996	Nakajima	359/650
5,625,495	4/1997	Moskovich	359/663
5,644,435	7/1997	Shikama	359/691
5,812,326	9/1998	Yamada	359/749
5,822,128	10/1998	Sekine	359/650
5,822,129	10/1998	Sekine	359/651
5,841,587	11/1998	Moskovich	359/662
5,870,228	2/1999	Kreitzer et al.	359/649
5,900,987	5/1999	Kreitzer	359/649
5,900,989	5/1999	Kreitzer	359/691
5,963,375	10/1999	Kreitzer	359/650
5,969,874	10/1999	Moskovich	359/651
5,969,876	10/1999	Kreitzer et al.	359/651
5,991,089	11/1999	Kreitzer	359/649
6,023,375	2/2000	Kreitzer	359/649

FOREIGN PATENT DOCUMENTS

311116 4/1989 (EP) .
WO99/08138 2/1999 (WO) .

OTHER PUBLICATIONS

The Handbook of Plastic Optics, U.S. Precision Lens, Inc.,
Cincinnati, Ohio, 1983, pp. 17-29.

Primary Examiner—Evelyn A Lester

(74) *Attorney, Agent, or Firm*—Maurice M. Klec

(57) **ABSTRACT**

A projection lens for use with LCD panels is provided. The lens has a first lens unit which includes a strong negative lens element having an aspherical surface which provides distortion correction, and a second lens unit which includes a first lens subunit separated by an airspace from a second lens subunit, wherein the first lens subunit has a strong positive power and the second lens subunit has a weaker power. The second lens subunit can include a negative lens element, followed by a positive lens element, followed by a plastic lens element having an aspherical surface. The projection lens has a field of view of at least 35° so that the overall projection lens system has a compact size.

16 Claims, 6 Drawing Sheets

